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Site 2 – Fire Training Area Air Sparging/Soil Vapor Extraction System 2000 Operation

Naval Weapons Industrial Reserve Plant

Calverton, New York

Northern Division
Naval Facilities Engineering Command
Contract Number N62472-90-D-1298
Contract Task Order 0223

March 2001

TETRA TECH NUS, INC.

SITE 2 – FIRE TRAINING AREA
AIR SPARGING/SOIL VAPOR EXTRACTION SYSTEM
2000 OPERATION

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
CALVERTON, NEW YORK

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Northern Division
Environmental Branch Code 18
Naval Facilities Engineering Command
10 Industrial Highway, Mail Stop #82
Lester, Pennsylvania 19113-2090

Submitted by:
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CONTRACT NUMBER N62472-90-D-1298
CONTRACT TASK ORDER 0223

MARCH 2001

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ACRONYMS AND ABBREVIATIONS

AFFF	aqueous fire fighting foam
AS/SVE	air sparging/soil vapor extraction
ARAR	applicable or relevant and appropriate requirement
BTU	British Thermal Unit
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLEAN	Comprehensive Long-Term Environmental Action Navy
CMS	Corrective Measures Study
CSF	Cancer Slope Factor
CTO	Contract Task Order
DO	dissolved oxygen
DOH	Department of Health
EE/CA	Engineering Evaluation and Cost Analysis
ECM	Electronic Counter Measure
EPA	U.S. Environmental Protection Agency
EVS	Environmental Visualization System
FS	Feasibility Study
ft/min	feet per minute
GC	gas chromatography
GOCO	Government-Owned Contractor-Operated
HI	hazard index
HNUS	Halliburton NUS Corporation
HQ	hazard quotient
IAS	Initial Assessment Study
ICR	incremental cancer risk
IEUBK	Integrated Exposure Uptake Biokinetic
IR	Installation Restoration
KOC	organic carbon partition coefficient
MCL	Maximum Contaminant Level
mg/kg	milligram per kilogram
MPC	Marine Pollution Control
msl	mean sea level
NAVFAC	Naval Facilities Engineering Command
NTU	nephelometric turbidity unit
NWIRP	Naval Weapons Industrial Reserve Plant
NYSDEC	New York State Department of Environmental Conservation

PA	Preliminary Assessment
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PID	photo ionization detection
POL	petroleum, oil, and lubricant
QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RI	Remedial Investigation
SI	Site Investigation
SOP	Standard Operating Procedure
SVOC	semivolatile organic compound
SWMU	Solid Waste Management Unit
TAGM	Technical and Administrative Guidance Memorandum
TBC	to be considered
TCL	Target Compound List
TtNUS	Tetra Tech NUS, Inc.
USDOI	U.S. Department of the Interior
VOC	volatile organic compound
µg/kg	microgram per kilogram
µg/L	microgram per liter

1.0 INTRODUCTION

1.1 PURPOSE

The Northern Division of the Naval Facilities Engineering Command (NAVFAC) has issued Contract Task Order (CTO) 0223 to Tetra Tech NUS, Inc. (TtNUS) under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract N62472-90-D-1298 to operate an Air Sparging/Soil Vapor Extraction System (AS/SVE) at Site 2 – Fire Training Area at the Naval Weapons Industrial Reserve Plant (NWIRP), located in Calverton, New York.

This work is part of the Navy's Installation Restoration (IR) Program, which is designed to identify contamination of Navy and Marine Corps lands/facilities resulting from past operations and to institute corrective measures, as needed. There are typically four distinct stages. Stage 1 is the Preliminary Assessment (PA), which was formerly known as the Initial Assessment Study (IAS). Stage 2 is a Resource Conservation and Recovery Act (RCRA) Facility Assessment-Sampling Visit (RFA), also referred to as a Site Investigation (SI), which augments the information collected in the PA. Stage 3 is the RFI/Corrective Measures Study (CMS), also referred to as a Remedial Investigation/Feasibility Study (RI/FS), which characterizes the contamination at a facility and develops options for remediation of the site. Stage 4 is the Corrective Action, also referred to as the Remedial Action, which results in the control or cleanup of contamination at sites. Site 2 is currently in the RI/FS stage.

The operation of the AS/SVE system serves as an interim action to treat organically contaminated soils and groundwater at the site while the RI and FS for the site are being completed. In addition to Site 2, Phase 2 RI testing is continuing at several other IR sites. The results from the investigations at the other sites will be presented in separate Phase 2 RI reports.

The Phase 2 RI, which is analogous to a Phase 2 RFI, was conducted in accordance with the requirements of the New York State Department of Environmental Conservation (NYSDEC) Division of Solid & Hazardous Materials Part 373 Permit that was issued to the Navy on April 18, 2000 under their implementing regulations (6 NYCRR Part 621). This permit supercedes and replaces the original Part 373 Permit to Operate a Hazardous Waste Storage Facility that was issued to then Grumman Aerospace Corporation on March 25, 1992. The new permit,

issued only to the Department of Navy, deals exclusively with those Solid Waste Management Units (SWMUs) that remain on the former NWIRP Calverton property and any Corrective Actions that may be required in order to adequately address each IR site. Although the Part 373 Permit is the enforceable document governing the Navy's remedial actions, the NYSDEC State Superfund group, located out of the Albany office, retains primary responsibility for regulatory oversight of the Navy's actions. As such, the Navy has agreed to a request made by the NYSDEC State Superfund group to utilize terminology associated with the NYSDEC State Superfund program which is closely related to the Federal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) program. The CERCLA terminology that is to be used parallels the RCRA terminology, and the implementation phases of each have been determined to meet the substantive requirements of both programs and will also satisfy the Corrective Action requirements set forth in Module III of the Part 373 Permit.

The site is listed as Classification 2 in the NYSDEC Registry of Inactive Waste Disposal Sites.

1.2 FACILITY LOCATION

Site 2 is located within the confines of NWIRP Calverton, Suffolk County, New York (see Figure 1-1 and Figure 1-2). NWIRP Calverton is located on Long Island approximately 70 miles east of New York City. The facility is located within the municipality of Riverhead.

Prior to 1996, NWIRP Calverton was a government-owned contractor-operated (GOCO) facility that was operated by the Northrop Grumman Corporation. The facility had an overall area of approximately 6,000 acres, of which 3,000 acres lie entirely within a fenced-in boundary. The majority of the industrial activity was confined to the south central portion of this fenced-in area.

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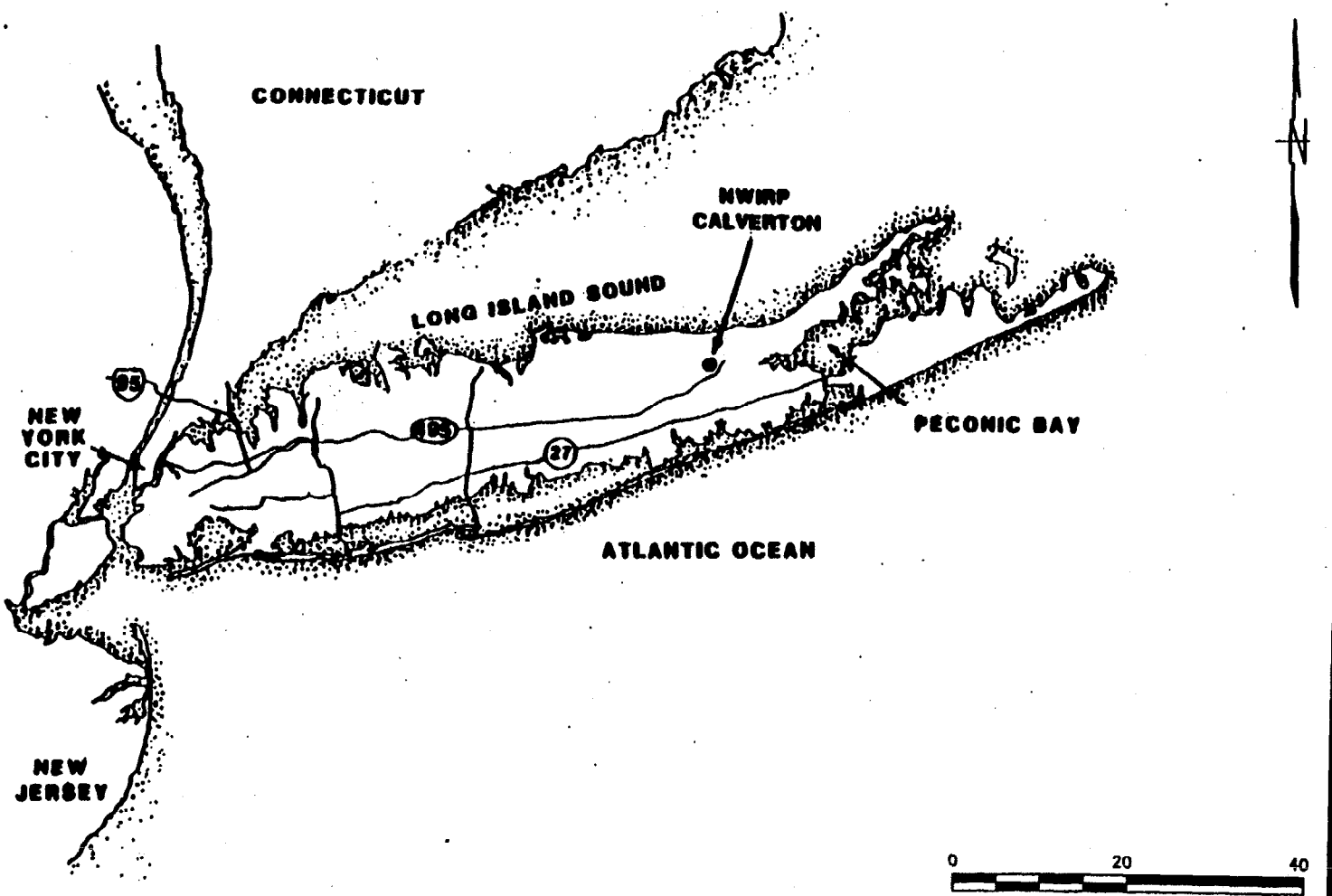

DRAWN BY DLT DATE 12/22/99	Tetra Tech NUS, Inc.	CONTRACT NO. 7398	OWNER NO.
CHECKED BY DATE	GENERAL LOCATION MAP RCRA FACILITY INVESTIGATION NWIRP, CALVERTON, NEW YORK	APPROVED BY	DATE
COST/SCHED–AREA		APPROVED BY	DATE
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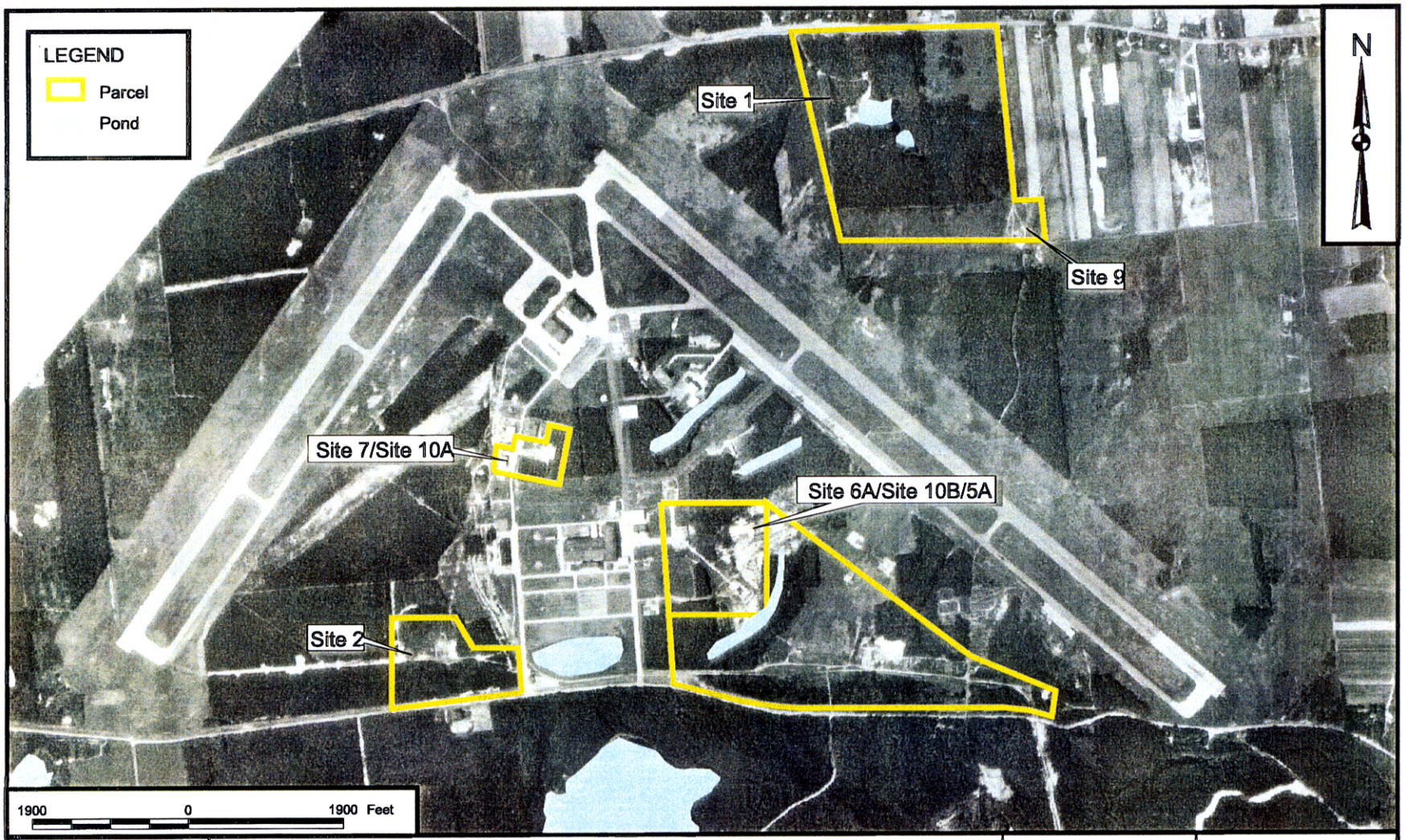

DRAWN BY: J. LAMEY — DATE: 11/22/99	Tetra Tech NUS, Inc.	CONTRACT NUMBER: 7398	OWNER NUMBER: 0270
CHECKED BY: — — DATE: —	SITE LOCATION MAP NWIRP CALVERTON, NEW YORK	APPROVED BY: — DATE: —	
COST/SCHEDULE-AREA		APPROVED BY: — DATE: —	
SCALE: AS NOTED		DRAWING NO.: FIGURE 1-2	REV: 0

P:\GIS\NWIRP_CALVERTON\SURFACE_WATER_HYDROLOGY.APR SITE LOCATION MAP 01/04/01 JAL

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Currently, NWIRP Calverton consists of four separate parcels of land totaling approximately 358 acres. Eight Navy IR sites are included within these parcels as follows. The location of the parcels and sites are presented in Figure 1-2.

Parcel A (32 acres)

Site 2 - Fire Training Area

Parcel B1 (40 acres)

Site 6A - Fuel Calibration Area

Site 10B - Engine Test House

Parcel B2 (131 acres)

Southern Area

Parcel C (10 acres)

Site 7 - Fuel Depot

Site 10A - Jet Fuel Systems Laboratory

Parcel D (145 acres)

Site 1- Northeast Pond Disposal Area

Site 9 - ECM Area

1.3 FACILITY HISTORY

NWIRP Calverton has been owned by the U.S. Department of the Navy (Navy) since the early 1950s, at which time the land was purchased from a number of private owners. The facility was expanded in 1958 through additional purchases of privately owned land. Northrop Grumman Corporation (previously Grumman Corporation) leased the land and was the sole operator of the facility from its construction until February 1996. In 1996, facility operations ceased and the land was returned to the Navy.

In September 1998, the majority of the land within the developed section of the facility was transferred to the Town of Riverhead for redevelopment. Because of the need for additional

environmental investigation and the potential need for remediation, the Navy retained four parcels of land within the developed section. The four parcels and associated Navy IR Sites are presented on Figure 1-2.

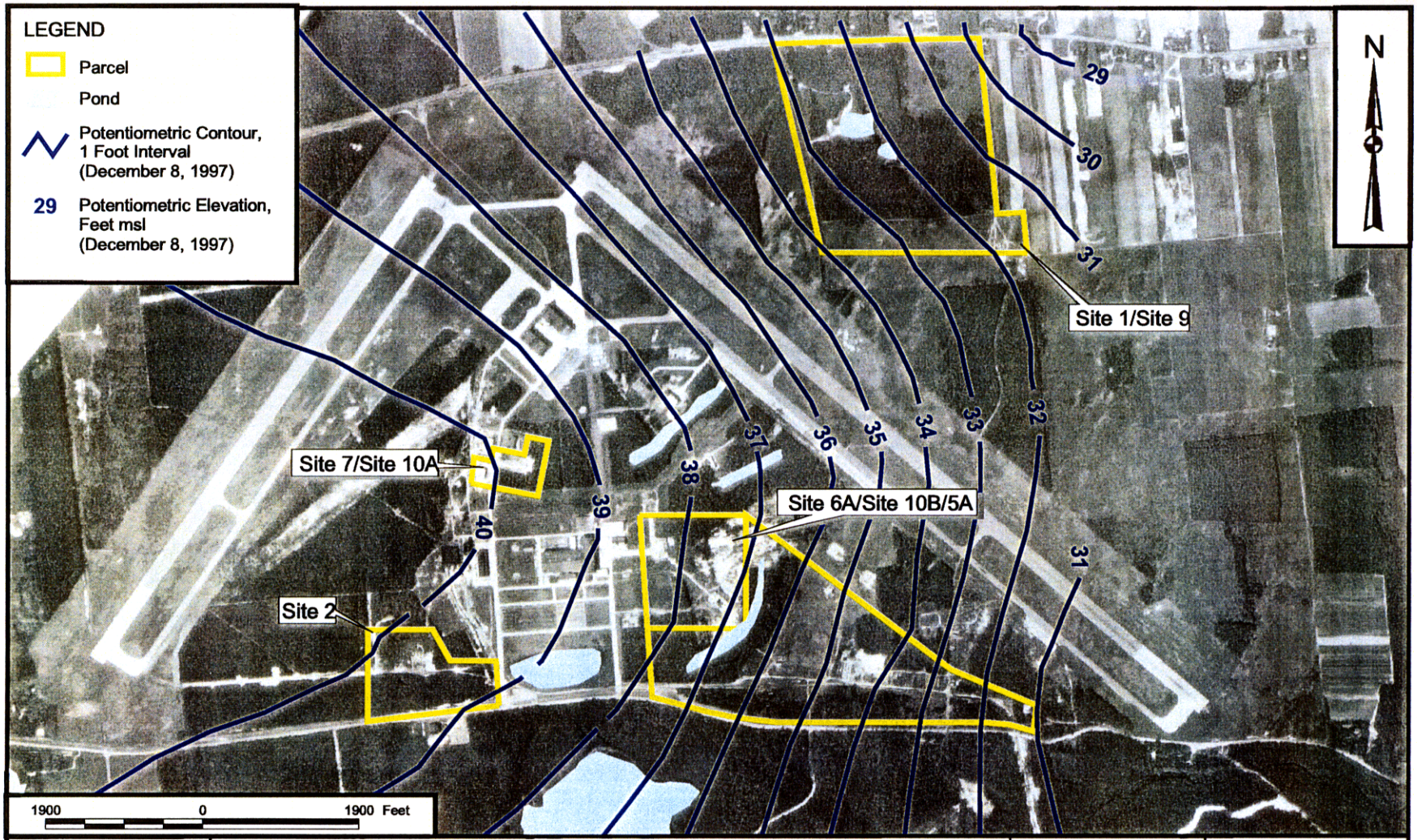
In September 1999, 2,935 acres of undeveloped land outside the fenced areas was transferred to NYSDEC who will continue to manage the property for resource conservation and recreational uses. An additional 140 acres of the northwest buffer zone was transferred to the Department of Veterans Affairs and will be used for expansion of the Calverton National Cemetery.

NWIRP Calverton was constructed in the early 1950s for use in the development, assembly, testing, refitting, and retrofitting of naval combat aircraft. The facility supported aircraft design and production at the Northrop Grumman's Bethpage facility, which is located in Nassau County, New York.

The majority of industrial activity at the facility was confined to the developed area in the center and south center of the facility between the two runways. Industrial activities at the facility were related to the manufacturing and assembly of aircraft and aircraft components. Operations which resulted in hazardous waste generation included but were not limited to metal finishing processes, such as metal cleaning and electroplating, other maintenance operations, temporary storage of hazardous waste, fueling operations, and training operations. The painting of aircraft and components resulted in additional waste generation.

1.4 SURFACE WATER HYDROLOGY

The majority of the NWIRP Calverton is located within the Peconic River drainage basin. The eastward-flowing Peconic River is located approximately 1,300 feet south of the facility at its closest point. The Peconic River discharges to Peconic Bay located 8.5 stream miles from the facility. Surface water hydrology is illustrated on Figure 1-3.



DRAWN BY: J. LAMEY — DATE: 11/4/99	Tetra Tech NUS, Inc.	CONTRACT NUMBER: 7398	OWNER NUMBER: 0270
CHECKED BY: — — DATE: —	SURFACE WATER HYDROLOGY AND GROUNDWATER CONTOUR MAP NWIRP CALVERTON, NEW YORK	APPROVED BY: — DATE: —	
COST/SCHEDULE-AREA		APPROVED BY: — DATE: —	
SCALE: AS NOTED		DRAWING NO.: FIGURE 1-3	REV: 0

P:\GIS\NWIRP_CALVERTON\SUFACE_WATER_HYDROLOGY.APR SUFACE WATER HYDROLOGY 01/04/01 JAL

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Major surface water features near the facility include McKay Lake and Northeast Pond (see Figure 1-3). McKay Lake is a man-made groundwater recharge basin located north of River Road, midway along the southern site border. Northeast Pond is located at the northeast corner of the facility. Several small drainage basins exist near the Fuel Calibration Area (Runway Ponds). All of these surface water features are land locked, with the exception of McKay Lake, which has an intermittent discharge to Swan Pond, located 1,500 feet to the south of NWIRP Calverton. Overland flow from the drainage basins to the Peconic River may also occur periodically.

A number of small wetlands exist on the Calverton facility. The U.S. Department of the Interior (USDOI), Fish and Wildlife Department classifies the western half of the 2-acre Northeast Pond as palustrine, forested/scrub/shrub/emergent wetland. The drainage basins are classified as palustrine, scrub/shrub/emergent wetland (USDOI, 1980).

1.5 PREVIOUS INVESTIGATIONS

Previous investigations at the site consisted of the following:

- IAS (Navy, 1986)
- SI (HNUS, 1992a)
- Hazard Ranking System Preliminary Scoring and Site Inspection Report Form (HNUS, 1992b)
- RFI (HNUS, 1995a)
- RFI Addendum (HNUS, 1995b)
- Pilot Scale Air Sparging/Soil Vapor Extraction System Work Plan (CF Braun, 1995c)
- Summary Results Report for Pilot Scale Air Sparging/Soil Vapor Extraction System (CF Braun, 1996a)
- Phase 2 Air Sparging/Soil Vapor Extraction System Pilot Study (CF Braun, 1996b)
- Phase 2 Remedial Investigation for Site 2 Fire Training Area (TtNUS 2001).

2.0 SITE BACKGROUND

A detailed site background for Site 2 can be found in the Phase 2 Remedial Investigation for Site 2 - Fire Training Area (TtNUS 2001). The site description, physical settings, and site chronology are summarized below.

2.1 SITE DESCRIPTION AND PHYSICAL SETTING

Site 2 – Fire Training Area is located on the eastern side of a 9-acre clearing in the south-central area of the NWIRP Calverton facility and is shown on Figure 2-1. A circular, concrete pit in the southeast corner of the clearing was used to contain liquids for fire training exercises. The pit is approximately 50 feet in diameter and is located approximately 750 feet north and 1,000 feet west of the facility south gate. A 1,000-gallon, steel, aboveground storage tank located approximately 75 feet north of the training pit was used to store fuel. This tank was removed in 1996. A 6,000-gallon underground fuel storage tank was located north of the training area before 1982 (Navy, 1986.)

The eastern portion of the fire training area was partially excavated at an unknown time. A small embankment up to 4 feet high is located along the eastern edge of the area, and a dirt access road is located along the southern edge. The fire training area is surrounded by woodlands. The majority of the area within the clearing to the west of the concrete pit is covered by marsh-type vegetation, although there is no evidence of standing water. The water table is approximately 10 to 15 feet below ground surface.

The underlying soils are predominately sands, with silt and clay lenses. Groundwater flow is to the south southeast toward the Peconic River.

2.2 SITE CHRONOLOGY

1952/55 to 1982: Fire fighting exercises were conducted in unlined earthen pits, by floating petroleum products and solvents on top of a water layer.

1982: A fuel spill was noted. 327 cubic yards of contaminated soils were removed. Four groundwater monitoring wells were installed and the underground storage tank was removed.

A new above ground storage tank and a concrete ring structure were installed. Fire fighting activities continued in the ring until approximately 1995.

1983: A fuel spill was noted and remediated.

1987: 14 additional monitoring wells were installed to delineate the extent of petroleum contamination.

1985 to 1986: The Navy conducted an Initial Assessment Study for NWIRP Calverton and identified the Site 2 - Fire Training Area as a potential area of concern.

1987: 14 additional monitoring wells were installed to delineate the extent of petroleum contamination.

A groundwater and free product extraction (floating petroleum) system was installed to collect floating free product on the water table.

1988 to 1991: Groundwater and free product extraction continued until 1993. Passive free product recovery continued until 1996 and was then restarted in 2000.

1991 to 1992: The Navy conducted a Site Investigation at NWIRP Calverton and confirmed the presence of contamination and recommended that a Remedial Investigation be conducted to delineate the nature and extent of contamination.

1993 to 1994: The Navy prepared a work plan to conduct a remedial investigation at several sites at Calverton, including Site 2 - Fire Training Area.

1994 to 1995: The Navy conducted a Remedial Investigation at Site 2.

1995: The Navy conducted a large-scale air sparging/soil vapor extraction (AS/SVE) pilot test at Site 2. A reduction in petroleum products and solvents in soils and groundwater was noted. The AS/SVE system was operated seasonally in 1996, 1997, 1998, and 2000.

1996 to 1997: The Navy prepared a work plan to conduct a Phase 2 remedial investigation at several sites including Site 2.

1997: The Navy establishes the Restoration Advisory Board for NWIRP Calverton.

1997 to 1998: The Navy conducted a Phase 2 Remedial Investigation at Site 2. Specific areas addressed include onsite groundwater near the fence, off site groundwater near the site, offsite seeps and an off-site irrigation well. A draft report was submitted to the regulators.

1998: The Navy conducted an engineering evaluation/cost analysis for several sites including Site 2. The analysis recommended that free product recovery be restarted at Site 2.

1999: The Navy conducts groundwater extraction tests in anticipation of a new free product recovery system (vapor-assisted oil skimming -- VAOS). However, based on subsequent field testing, several interferences were noted that impact the ability to successfully extract and treat the groundwater. An alternate recommendation was made to recover product using passive techniques (i.e. absorbent pillows).

2000: The Navy proceeds with passive free product recovery and restarts the AS/SVE system at Site 2. As of December 2000, only minor levels of residual free product are noted.

3.0 SYSTEM OPERATION

3.1 SUMMARY OF OPERATION

The AS/SVE system operated for a period of approximately seven months. Operation of this phase of the AS/SVE system began on May 8, 2000 and ended on December 5, 2000. Specific operation information and exceptions to the continuous operation of the AS/SVE system are detailed in the following section.

3.2 MONTHLY OPERATIONS AND ACTIVITIES

3.2.1 May 2000 activities

The seasonal startup of the AS/SVE system for this phase of activities was conducted from May 8 through May 10, 2000. During the system startup the following activities were performed:

- Broken/cracked piping was repaired.
- Injection and extraction blower motors were greased and oil was changed.
- Belts on each of the motors were checked and adjusted.
- Air filters on each of the systems were changed.
- PID readings for VOCs and Draeger tube samples for carbon dioxide were collected from extraction well banks. Flow rates on each of the air injection and air extraction system well banks were measured and adjusted to obtain optimal velocities.
- Condensate was drained from the system piping and moisture knockout drum.
- The initial power meter reading was observed and recorded (43855 kilowatt-hours). Note that the power meter readings measures the system operation. The air injection blower requires approximately 5 horsepower to operate (3.5 kilowatts) and the soil vapor extraction blower requires approximately 3 horsepower to operate (2.2 kilowatts).

Inspection of the AS/SVE system was conducted on May 23 and May 24, 2000. The following activities were conducted during the inspection:

- Initial and final power meter readings were recorded (45127 and 45273 kilowatt-hours).

- The belt on the air injection system was changed.
- Broken/cracked piping was repaired.
- Draeger tube samples for carbon dioxide and vinyl chloride were collected from the air extraction discharge stack. Vinyl chloride was not detected.
- Flow rates were measured on each of the air injection system well banks.

3.2.2 June 2000 Activities

Inspection of the AS/SVE system was conducted on June 5 and June 21, 2000. The following activities were conducted during the inspections:

- Power meter readings were recorded for each date (47149 and 49674 kilowatt hours).
- The entire system was inspected for leaks, broken piping, loose belts, and condensate accumulation. No problems were noted during each of the inspections.

3.2.3 July 2000 activities

Inspection of the AS/SVE system was conducted on July 13, 2000. The following activities were conducted:

- Power meter reading was recorded (51343 kilowatt-hours).
- Injection blower motor was not running upon arrival. The injection system was checked and restarted.

Inspection of the AS/SVE system was conducted on July 17, 2000. The following activities were conducted:

- Power meter reading was recorded (51724 kilowatt-hours).
- The entire system was inspected for leaks, broken piping, loose belts, and condensate accumulation.
- Flow rates were measured and adjustments were made on several of the injection system well banks. During these adjustments, the belt on the injection blower motor burned up. The air injection system was shut down.

Inspection of the AS/SVE system was conducted on July 18, 2000. The following activities were conducted:

- The belt on the injection blower motor was changed.
- The air injection system was restarted.

Inspection of the AS/SVE system was conducted on July 19, 2000. The following activities were performed:

- The power meter reading was recorded (51952 kilo-watt hours)
- Flow readings were collected and adjustments were made to each of the air injection system well banks.

Inspection of the AS/SVE system was conducted on July 31, 2000. The following activities were performed:

- The power meter reading was recorded (53606 kilowatt-hours).
- The entire system was inspected for leaks, broken piping, loose belts, and condensate accumulation. No problems were noted during the inspection.

3.2.4 August 2000 activities

Inspection of the AS/SVE system was conducted on August 4, 2000. The following activities were performed:

- Entire system was inspected for leaks, broken piping, loose belts, and condensate accumulation. No problems were noted during the inspection.

Inspection of the AS/SVE system was conducted on August 7 and 8, 2000. The following activities were performed:

- The power meter reading was recorded (54180 kilowatt-hours).
- Routine check of the air–injection system motor revealed that the belt was slipping slightly. Due to severe weather at the time of the inspection, no adjustments were made to the belt.

- The belt on the air injection system motor was changed.
- The entire system was inspected for leaks, broken piping, loose belts, and condensate accumulation. No problems were noted during the inspection.

Inspection of the AS/SVE system was conducted on August 11, 2000. The following activities were performed:

- An air sample was collected from the exhaust stack of the air-extraction system discharge. A background air sample was also collected from a point upwind of the AS/SVE system. Samples were sent to Severn Trent Laboratories for analysis. Analytical results are presented in Section 4.0.

Inspection of the AS/SVE system was conducted on August 15, 2000. The following activities were performed:

- The power meter reading was recorded (55304 kilowatt-hours).
- The entire system was inspected for leaks, broken piping, loose belts, and condensate accumulation. The air injection system was shut down temporarily in order to repair a broken pipe between two of the well banks. No other problems were noted during the inspection.

3.2.5 September 2000 Activities

Inspection of the AS/SVE system was conducted on September 20, 2000. The following activities were performed:

- The power meter reading was recorded (60664 kilowatt-hours).
- PID readings for VOCs and Draeger tube samples for carbon dioxide and vinyl chloride were collected from the air-extraction system exhaust discharge. Vinyl chloride was not detected. Flow rates on each of the air injection and air-extraction system well banks were measured and adjusted to obtain optimal velocities.
- The entire system was inspected for leaks, broken piping, loose belts, and condensate accumulation. No problems were noted during the inspection.
- A water level reading was obtained from within Monitoring well MW-02 (14.85 feet top of casing (TOC)).

3.2.6 October 2000 Activities

Inspection of the AS/SVE system was conducted on October 2 and 3, 2000. The following activities were performed:

- The power meter reading was recorded (61551 kilowatt-hours).
- The AS/SVE system was not operating upon arrival at the site. The oil in each of the air injection and air-extraction system motors was changed and adjustments were made to each of the system motor belts.
- The AS/SVE system was restarted.
- The entire system was inspected for leaks, broken piping, loose belts, and condensate accumulation. No problems were noted during the inspection.
- A water level reading was obtained from within Monitoring well MW-02 (14.90 feet TOC.).
- The power meter reading was recorded (61727 kilowatt-hours).
- An air sample was collected from the exhaust stack of the air-extraction system discharge. A background air sample was also collected from a point upwind of the AS/SVE system. Samples were sent to Severn Trent Laboratories for analysis.

3.2.7 November 2000 Activities

Inspection of the AS/SVE system was conducted on November 11, 2000. The following activities were performed:

- The power meter reading was recorded (64543 kilowatt-hours).
- Draeger tube sample for carbon dioxide was collected from the air-extraction system exhaust discharge.
- The entire system was inspected for leaks, broken piping, loose belts, and condensate accumulation. No problems were noted during the inspection.
- The oil in each of the air injection and air-extraction system motors was changed.

3.2.8 December 2000 Activities

Inspection of the AS/SVE system was conducted on December 4, 2000. The following activities were performed:

- The power meter reading was recorded (66740 kilowatt-hours).
- The AS/SVE system was not operating upon arrival at the site. The oil in each of the air injection and air-extraction system motors was changed and adjustments were made to each of the system motor belts.
- The AS/SVE system was restarted.
- The entire system was inspected for leaks, broken piping, loose belts, and condensate accumulation. No problems were noted during the inspection.

Inspection of the AS/SVE system was conducted on December 5, 2000. The following activities were performed:

- The entire system was inspected for leaks, Broken piping, loose belts, and condensate accumulation. No problems were noted during the inspection.
- An air sample was collected from the exhaust stack of the air-extraction system discharge. A background air sample was also collected from a point upwind of the AS/SVE system. Samples were sent to Severn Trent Laboratories for analysis.
- PID readings for VOCs and Draeger tube samples for carbon dioxide and vinyl chloride were collected from the air-extraction system exhaust discharge.
- The AS/SVE system was shut down and secured for the winter.
- The final power meter reading was recorded (66770 kilowatt-hours).

3.3 OVERVIEW OF SYSTEM OPERATION

Based on the power meter readings, the system operated 79% of the time. Down times were attributed primarily to power outages and to a lesser extent, equipment breakdown and maintenance.

Soil vapor extraction and air injection velocity measurements are presented in Table 3-1. These values are consistent with previous operations at the site. The soil vapor extraction wells

operate with little variation in flow rates. However, distribution of air through the injection wells can be highly variable and is dependent primarily on the groundwater table elevation. The groundwater table fluctuates from a high in the spring to a low in the fall. Also, air injection rates are limited on some of the wells, because of the size of the blower motor and the head pressure required to displace the water column in those wells.

3.4 SAMPLING ACTIVITIES

Sampling activities were limited during this operational period. Draeger tubes were used to measure carbon dioxide (CO2) and vinyl chloride in the offgas and to a limited extent in individual soil vapor extraction well clusters.

Air samples were also collected in tedlar bags and shipped to Severn Trent Laboratories for a volatile organic scan using method TO-14A. Chain of custody forms and laboratory analytical sheets are presented in Appendix A. Results are discussed in Section 4.0.

TABLE 3-1

AIR INJECTION/SOIL VAPOR EXTRACTION VELOCITY READINGS
AIR SPARGING/SOIL VAPOR EXTRACTION SYSTEM
FIRE TRAINING AREA
NWIRP CALVERTON, NEW YORK

Well Number	Test Date				
	05/09/00	05/10/00	05/24/00	07/19/00	09/20/00
Air Injection Wells					
I1	175/175	190	500	250/250	400/400
I2	150/150	210	390	325/325	400/400
I3	600/500	490	525	400/400	625/575
I4	725/550	600	600	725/425	675/600
I5	350/350	575	750	675/525	725/675
I6	40/40	120	375	625/425	375/400
I7	25/25	0	75	125/125	120/125
I8	250/250	400	600	675/575	625/625
I9	10/10	75	250	425/425	275/275
I10	30/30	150	300	275/275	325/350
I11	15/15	0	50	150/150	75/75
I12	0/0	0	75	125/125	100/100
I13	40/40	50	50	100/100	75/75
I14	300/300	450	625	425/425	675/650
I15	0/0	50	50	50/50	75/75
I16	55/55	375	450	275/275	500/525
Soil Vapor Extraction Wells					
E1-E6		350			375
E7-E9		250			275
E10-E12		300			325
E13-E17 (west)		1400			1400
E13-E17 (east)		550			600
E18-E22		1400			1375
E23-E29		900			900
E30-E32		1400			1425

Air velocities are measured in the field as feet per minute. The measurements are made in 2 inch diameter PVC pipes. To convert from feet per minute to CFM, multiply by 0.022, (e.g. 175 feet per minute is 3.8 CFM).

Velocities presented with two numbers indicate that the valve position was adjusted and the values represent the velocity before and after adjustment.

See the Phase 1 and Phase 2 reports for well locations ((CF Braun 1996a and CF Braun 1996b). Wells I1 and E1 are to the north and upgradient of the site and Wells E32 and I16 are to the south and are downgradient of the site.

4.0 RESULTS

The test results during this period of operation consisted of limited Soil Vapor Extraction header testing for carbon dioxide and stack off gas analysis for carbon dioxide, vinyl chloride, and volatile organic compounds (VOCs). Carbon dioxide and VOC results are presented in Tables 4-1 and 4-2, respectively. Vinyl chloride was not detected in any of the samples.

The carbon dioxide results indicate that biodegradation of hydrocarbons continues to occur at the Fire Training Area. Carbon dioxide readings as high as 6.0 to 9.0% were detected in several of the extraction wells during the initial startup of the system. The location of these elevated readings is in the area of the historic floating free product layer. These readings also indicate that biodegradation continues to occur in the area even when the air sparging/soil vapor system is shutdown. After startup and a period of operation, the carbon dioxide readings approach approximately 0.5% in the combined off gas and the concentration is relatively constant for the duration of the operation. This same trend has been observed during the historic operation as well. For comparison, carbon dioxide readings in the ambient air were consistently less than 0.1% and were measured to average approximately 0.15% in soil vapor extraction wells located away from the area of significant soil and groundwater contamination.

Previous estimates indicate that approximately 24,500 pounds of hydrocarbons (as carbon (C)) were degraded and removed through the soil vapor extraction system during the 1995 and 1996 system operation. Additional degradation of hydrocarbons is likely to have occurred, but would not be accounted for in these calculations because they were not captured by the soil vapor extraction system. During the period of 1997 through 2000, an estimated additional 25,100 pounds of hydrocarbons (as C) were degraded, for a total of approximately 50,000 pounds. This total is equivalent to 8,400 gallons of fuel.

Based on carbon dioxide measurements, the estimated biodegradation rate for hydrocarbons during the 2000 system operation was 8,300 pounds (as C) or the equivalent of 1,400 gallons of fuel.

As indicated in Table 4-2, the target VOCs discharged through the SVE system during the 2000 operation totaled less than 0.1 part per million by concentration and 1 pound total. These findings indicate that removal of contaminants at the site by volatilization is minimal.

TABLE 4-1

SOIL VAPOR EXTRACTION HEADER
CARBON DIOXIDE RESULTS (%)
AIR SPARGING/SOIL VAPOR EXTRACTION SYSTEM
FIRE TRAINING AREA
NWIRP CALVERTON, NEW YORK

SVE lines	05/09/00	05/10/00	05/24/00	09/20/00	11/07/00	12/05/00
E1-E6	1.5	1.5				
E7-E9	3.0	4.0				
E10-E12	3.0	6.0				
E13-E17 (west)	6.0	5.0				
E13-E17 (east)	9.0	4.0				
E18-E22	4.5	0.5				
E23-E29	0.5	0.5				
E30-E32	1.0	0.5				
Combined (E1-E32)	4.5	2.5	0.5	0.5	0.5	0.5

See the Phase 1 and Phase 2 reports for well locations (CF Braun 1996a and CF Braun 1996b). Well E1 is to the north and upgradient of the site and Well E32 is to the south and is downgradient of the site.

TABLE 4-2

OFFGAS RESULTS (ppb-volume)
AIR SPARGING/SOIL VAPOR EXTRACTION SYSTEM
SITE 2 - FIRE TRAINING AREA
NWIRP CALVERTON, NEW YORK

Parameter	Offgas 08/11/2000	Field Blank 08/11/2000	Offgas 10/03/2000	Field Blank 10/03/200	Offgas 12/05/00	Field Blank 12/0500
1,1-Dichloroethane	11		11		8.3	
1,1,1-Trichloroethane	30		21		22	
Trichloroethene	2					
Toluene	9.4	13				
Tetrachloroethene	13		10			
Xylene (m&p)	6.2	6.4	3	2.3		
Xylene (o)	2.5					
1,3,5-Trimethylbenzene	8.2					
1,2,4-Trimethylbenzene			2.5	2.2		
1,4-Dichlorobenzene			2.1	2.2		

5.0 CONCLUSIONS AND RECOMMENDATIONS

The conclusions and recommendation derived during this study are summarized as follows.

1. The Air Sparging/Soil Vapor Extraction System operated for a period of approximately seven months this year.

2. During this operation, only minimal quantities and VOCs were collected by the Soil Vapor Extraction System (less than one pound) and therefore, treatment of site contaminants by volatilization is minimal.

3. As evidenced by the quantity of carbon dioxide collected, biodegradation of hydrocarbons in the area continues to occur under both operating and non-operating periods. Degradation of hydrocarbons under aerobic conditions (during system operation) is expected to be more rapid than under anaerobic conditions (during down periods).

4. Since startup in 1995, this system has contributed to the biodegradation of approximately 50,000 pounds of hydrocarbons (as C), which is equivalent to approximately 8,400 gallons of diesel fuel (through December 2000). Of this total, in 2000 an estimated 8,400 pounds of hydrocarbons, equivalent to 1,400 gallons of diesel fuel were similarly biodegraded. Additional degradation during system down times likely occurred.

5. The Air Sparging/Soil Vapor Extraction system should continue to be operated at the site seasonally, as long as its operation does not interfere with other site activities. The primary benefit of the system is to enhance biodegradation of hydrocarbons.

REFERENCES

C.F. Braun, 1996a. Summary Results Report for Pilot Study Air Sparging/Vapor Extraction System, Naval Weapons Industrial Reserve Plant, Calverton, New York, June. King of Prussia, Pennsylvania. Contract Number N62472-90-D-1298, CTO 223.

C.F. Braun, 1996b. Phase 2 Air Sparging/Soil Vapor Extraction Pilot Study, Naval Weapons Industrial Reserve Plant, Calverton, New York, December. King of Prussia, Pennsylvania. Contract Number N62472-90-D-1298, CTO 223.

C.F. Braun, 1997. Phase 2 RCRA Facility Investigation Field Sampling Plan for Naval Weapons Industrial Reserve Plant, Calverton, New York. King of Prussia, Pennsylvania. Contract Number N62472-90-D-1298, CTO 270.

HNUS (Halliburton NUS Corporation), 1992a. Final Site Investigation, Naval Weapons Industrial Reserve Plant, Calverton, New York, April. King of Prussia, Pennsylvania. Contract Number N62472-90-D-1298, CTO 002.

HNUS (Halliburton NUS Corporation), 1992b. Hazard Ranking System Preliminary Scoring and Site Inspection Report Form, Naval Weapons Industrial Reserve Plant, Calverton, New York. King of Prussia, Pennsylvania.

HNUS, 1995a. Final RCRA Facility Investigation, Naval Weapons Industrial Reserve Plant, Calverton, New York, August. King of Prussia, Pennsylvania. Contract Number N62472-90-D-1298, CTO 138.

HNUS, 1995b. RCRA Facility Investigation Addendum, Naval Weapons Industrial Reserve Plant, Calverton, New York. King of Prussia, Pennsylvania. Contract Number N62472-90-D-1298, CTO 138.

NNUS, 1995c. Pilot-Scale Air Sparging/Soil Vapor Extraction Work Plan, Naval Weapons Industrial Reserve Plant, Calverton, New York, July. King of Prussia, Pennsylvania. Contract Number N62472-90-D-1298, CTO 223.

Navy, 1986. Initial Assessment Study of Naval Weapons Industrial Reserve Plant, Bethpage, New York and Naval Weapons Industrial Reserve Plant, Calverton, New York. Naval Energy and Environmental Activity, Philadelphia, Pennsylvania.

NYSDEC (New York State Department of Environmental Conservation), 1994. Technical and Administrative Guidance Memorandum Number 4046, Determination of Soil Cleanup Objectives and Cleanup Levels. Albany, New York.

TtNUS (Tetra Tech NUS, Inc.) 2001. Phase 2 Remedial Investigation for Site 2 - Fire Training Area, Naval Weapons Industrial Reserve Plant, Calverton, New York, February. King of Prussia, Pennsylvania. Contract Number N62472-90-D-1298, CTO 270.

APPENDIX A

CALCULATIONS, CHAIN OF CUSTODY FORMS, AND ANALYTICAL RESULTS.

A. SYSTEM OPERATION

Power meter was used to evaluate operation during the period.

Power consumption consisted of an Air Injection Blower and a Soil Vapor Extraction Blower

The controls on the unit allow the Air Injection Blower to only run when the Soil Vapor Extraction Blower is running. But, the Soil Vapor Extraction Blower can run without the Air Injection Blower.

Power consumption is as follows.

For calibration purposes, the system was documented to be running continuously from July 19, 2000 to July 31, 2000.

During this period, the power meter readings were 51,952 and 53, 606 kwhrs, respectively.

These readings correspond to an average power use of 138 kwhr per day

Equivalent Horsepower is 7.7 Horsepower.

This estimate is consistent with historic calculatations of 5 HP for the Air Injection Blower and 2.5 HP for the Soil Vapor Extraction Blower.

Power Meter Readings are as follows.

5/10/00	days	43,941 kwhrs	% operation
5/23/00	13	45,127	66%
7/17/00	55	51,727	87%
7/19/00	2	51,952	82%
7/31/00	12	53,606	100%
10/2/00	63	61,551	91%
12/5/00	64	66,770	59%
	209 days	22829 kwhrs	

Average operation based on power usage = 166 days of operation

Percentage of operation 79%

B. ESTIMATE OF DEGRADATION VIA CARBON DIOXIDE MEASUREMENTS.

Estimate through December 1996:

This estimate is based on an SVE rate of 225 SCFM (Average flow rate)
An average net CO2 exhaust of 0.99 % CO2 (see Phase 2 - Air Sparging/ Soil Vapor Extraction Pilot Study December 1996).
8 months of operation.

8 months*30.4days/month*1440min/day*225SCFM*0.075lb/CF*0.0099CO2*12/29 (MW conversion)
24,210 lbs as "C".

Total operation from December 1996 to December 2000 is 55510 kwhrs

This is equivalent to 403 days of operation

The blowers were down in 1999 while oil recovery tests were being conducted.

The Soil Vapor Extraction Blower is a positive displacement blower. Therefore, air flow is relatively constant at

200 SCFM

Carbon dioxide results were noted to vary during the operation period and was tracked extensively in 1996.

Data from the early reports is summarized as follows.

1995 average messured concentration	1.3 %
1996 average measured concentration	1.04 %
Average background concentration	0.15 %

CO2 readings during the subsequent years of operation were sporadic.

5/9/00	4.5 % (day of startup)
5/10/00	2.5
5/24/00	0.5
11/7/00	0.5

12/5/00	0.5	

For the period of 1997 through December 2000, use an average of 1996 (1.04%) and the end of December 2000 (0.5%)

Net Average is	0.62 %	
Over 403 days of operation:	25,124	lb of hydrocarbons as "C".
Total in 2000 is	8,346	lb of hydrocarbons as "C". (use 0.5% CO2)
Total to date for the AS/SVE system is	49,333	lbs as C
Say	50,000	lbs as C.

As hydrocarbon, this is equivalent to approximately

8,402 gallons of hydrocarbon

C. CHLORINATED SOLVENTS IN THE OFFGAS (ppb-volume)'

	8/11/00	10/3/00	12/5/00	
1,1-Dichloroethane	11	11	8.3	
1,1,1-Trichloroethane	30	21	22	
Trichloroethene	2			
Tetrachloroethene	13	10		
Toluene	9.4			
Xylene (m&p)	6.2	3		
Xylene (o)	2.5			
1,3,5-Trimethylbenzene	8.2			
1,2,4-Trimethylbenzene		2.5		
1,4-Dichlorobenzene		2.1		
Total Chlorinated Solvent	56	42	30.3	42.77
Total Non Chlorinated Solvents	26.3	7.6	0	11.3

Approximate Molecular Weight	131.5	chlorinated (1,1,1 TCA)
Approximate Molecular Weight	92	nonchlorinated (Toluene)

Total Chlorinated VOCs removed in 2000	0.06
Total Nonchlorinated VOCs removed in 2000	0.01

Chain of Custody Record

Quanterra

QUA-4124 0797

Client: Foster Wheeler - TENES	Project Manager: D. Brozek	Date: 8-11-00	Chain of Custody Number: 38338
Address: 664 Anderson Drive	Telephone Number (Area Code)/Fax Number: 412-921-8375	Lab Number: MDH140159	Page 1 of 1
City: Pittsburgh / State: Pa / Zip Code: 15220	Site Contact	Lab Contact: V. Barton	
Project Name: Coraopolis - S.V.E. System	Carrier/Waybill Number		
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Aqueous	Sed.	Soil	Grab	Containers & Preservatives: Unpres.	H_2SO_4	HNO_3	HCl	NaOH	ZnAc/NaOH	Analysis (Attach list if more space is needed): 8270 VOCs	Special Instructions/ Conditions of Receipt
FT-AS 0008-OG	8-11-00	0900				X							X	
FT-AS 0008-FB	8-11-00	0915				X							X	

Possible Hazard Identification

☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal

☐ Return To Client ☒ Disposal By Lab ☐ Archive For _____ Months (A fee may be assessed if samples are retained longer than 3 months)

Turn Around Time Required

☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other _____

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished By: David Brozek	8-11-00	940	1. Received By: [signature]	8-12-2000	1035
2. Relinquished By			2. Received By		
3. Relinquished By			3. Received By		

Comments

DISTRIBUTION: WHITE - Stays with the Sample; CANARY - Returned to Client with Report; PINK - Field Copy

Chain of Custody Record

SEVERN TRENT SERVICES — **Severn Trent Laboratories, Inc.**

STL-4124 (0700)

Client Tetra Tech NUS Inc.	**Project Manager** Dave Brzyzek	**Date** 12-5-00	**Chain of Custody Number** 023918
Address 600 Clarke Ave	**Telephone Number (Area Code)/Fax Number** (412) 921-8375 / (412) 921-4040	**Lab Number** MOLD60224	**Page** 1 of 1
City King of Prussia **State** PA **Zip Code**	**Site Contact** Vince Shickora	**Lab Contact**	
Project Name and Location (State) NWIRP Calverton New York	**Carrier/Waybill Number** Fed Ex # 805392174133		
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H_2SO_4	HNO_3	HCl	NaOH	ZnAc/NaOH	Analysis: (TO14) VOCs	Special Instructions/ Conditions of Receipt
FT-AS-0012-FB	12-5-00	0930	X										X	
FT-AS-0012-OG	12-5-00	0945	X										X	

Possible Hazard Identification
☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal
☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months (A fee may be assessed if samples are retained longer than 3 months)

Turn Around Time Required
☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other _____

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished By	12-5-00	1700	1. Received By	12/6/00	1030
2. Relinquished By			2. Received By		
3. Relinquished By			3. Received By		

Comments

DISTRIBUTION: White with sample; CANARY - Field Copy to Client with Report; PINK - Field Copy

Chain of Custody Record

Quanterra

QUA-4124 0797

Client: Tetra Tech NUS Corp.	Project Manager: Dave Brayack	Date: 10-03-00	Chain of Custody Number: 38337
Address:	Telephone Number (Area Code)/Fax Number: (412) 921-8375	Lab Number: MAJ040264	Page 1 of 1
City: Pittsburgh / State: PA / Zip Code:	Site Contact: Vince Shickora	Lab Contact:	
Project Name: NWIRP CAlverton CTO-223	Carrier/Waybill Number: Fed Ex # 805392174177		
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H_2SO_4	HNOS	HCl	NaOH	ZnAc/NaOH	Analysis (Attach list if more space is needed): Fed Ex Bill *	Special Instructions/ Conditions of Receipt
FT-AS-0010-FB	10-03-00	1400										1	
FT-AS-0010-OG	10-03-00	1415										1	

Possible Hazard Identification
☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal
☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months (A fee may be assessed if samples are retained longer than 3 months)

Turn Around Time Required
☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other _____

QC Requirements (Specify)

1. Relinquished By: Vince Shickora	Date: 10-03-00	Time: 1930	1. Received By:	Date: 10/4/00	Time: 1030
2. Relinquished By:	Date:	Time:	2. Received By:	Date:	Time:
3. Relinquished By:	Date:	Time:	3. Received By:	Date:	Time:

Comments: * ANALYSIS : VOC (TO-14) PER DAVE B. 10/4/00 MT

DISTRIBUTION: WHITE - Stays with the Sample; CANARY - Returned to Client with Report; PINK - Field Copy

TETRA TECH NUS, INC.

Client Sample ID: FT-AS0008-OG

GC/MS Volatiles

Lot-Sample #...: M0H140159-001	**Work Order #...:** DHTFE101	**Matrix.....:** AIR	
Date Sampled...: 08/11/00	**Date Received..:** 08/12/00		
Prep Date.....: 08/14/00	**Analysis Date..:** 08/14/00		
Prep Batch #...: 0228309			
Dilution Factor: 1			
Analyst ID.....: 064667	**Instrument ID..:** MSA		
	Method.....: EPA-21 TO-14A		

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Dichlorodifluoromethane	ND	2.0	ppb(v/v)
Chloromethane	ND	4.0	ppb(v/v)
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	2.0	ppb(v/v)
Vinyl chloride	ND	2.0	ppb(v/v)
Bromomethane	ND	2.0	ppb(v/v)
Chloroethane	ND	4.0	ppb(v/v)
Trichlorofluoromethane	ND	2.0	ppb(v/v)
1,1-Dichloroethene	ND	2.0	ppb(v/v)
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	2.0	ppb(v/v)
Methylene chloride	ND	2.0	ppb(v/v)
1,1-Dichloroethane	**11**	**2.0**	**ppb(v/v)**
cis-1,2-Dichloroethene	ND	2.0	ppb(v/v)
Chloroform	ND	2.0	ppb(v/v)
1,1,1-Trichloroethane	**30**	**2.0**	**ppb(v/v)**
Carbon tetrachloride	ND	2.0	ppb(v/v)
Benzene	ND	2.0	ppb(v/v)
1,2-Dichloroethane	ND	2.0	ppb(v/v)
Trichloroethene	**2.0**	**2.0**	**ppb(v/v)**
1,2-Dichloropropane	ND	2.0	ppb(v/v)
cis-1,3-Dichloropropene	ND	2.0	ppb(v/v)
Toluene	**9.4**	**5.0**	**ppb(v/v)**
trans-1,3-Dichloropropene	ND	2.0	ppb(v/v)
1,1,2-Trichloroethane	ND	2.0	ppb(v/v)
Tetrachloroethene	**13**	**2.0**	**ppb(v/v)**
1,2-Dibromoethane (EDB)	ND	2.0	ppb(v/v)
Chlorobenzene	ND	2.0	ppb(v/v)
Ethylbenzene	ND	2.0	ppb(v/v)
m-Xylene & p-Xylene	**6.2**	**2.0**	**ppb(v/v)**
o-Xylene	**2.5**	**2.0**	**ppb(v/v)**
Styrene	ND	2.0	ppb(v/v)
1,1,2,2-Tetrachloroethane	ND	2.0	ppb(v/v)
Benzyl chloride	ND	10	ppb(v/v)
1,3,5-Trimethylbenzene	**8.2**	**2.0**	**ppb(v/v)**
1,2,4-Trimethylbenzene	ND	2.0	ppb(v/v)
1,3-Dichlorobenzene	ND	2.0	ppb(v/v)

(Continued on next page)

TETRA TECH NUS, INC.

Client Sample ID: FT-AS0008-OG

GC/MS Volatiles

Lot-Sample #...: M0H140159-001 **Work Order #...:** DHTFE101 **Matrix.....:** AIR

PARAMETER	RESULT	REPORTING LIMIT	UNITS
1,4-Dichlorobenzene	ND	2.0	ppb(v/v)
1,2-Dichlorobenzene	ND	2.0	ppb(v/v)
1,2,4-Trichloro-benzene	ND	20	ppb(v/v)
Hexachlorobutadiene	ND	4.0	ppb(v/v)

TETRA TECH NUS, INC.

Client Sample ID: FT-AS0008-FB

GC/MS Volatiles

Lot-Sample #...: M0H140159-002 **Work Order #...:** DHTFT101 **Matrix.....:** AIR
Date Sampled...: 08/11/00 **Date Received..:** 08/12/00
Prep Date.....: 08/14/00 **Analysis Date..:** 08/14/00
Prep Batch #...: 0228309
Dilution Factor: 1
Analyst ID.....: 064667 **Instrument ID..:** MSA
Method.....: EPA-21 TO-14A

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Dichlorodifluoromethane	ND	2.0	ppb(v/v)
Chloromethane	ND	4.0	ppb(v/v)
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	2.0	ppb(v/v)
Vinyl chloride	ND	2.0	ppb(v/v)
Bromomethane	ND	2.0	ppb(v/v)
Chloroethane	ND	4.0	ppb(v/v)
Trichlorofluoromethane	ND	2.0	ppb(v/v)
1,1-Dichloroethene	ND	2.0	ppb(v/v)
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	2.0	ppb(v/v)
Methylene chloride	ND	2.0	ppb(v/v)
1,1-Dichloroethane	ND	2.0	ppb(v/v)
cis-1,2-Dichloroethene	ND	2.0	ppb(v/v)
Chloroform	ND	2.0	ppb(v/v)
1,1,1-Trichloroethane	ND	2.0	ppb(v/v)
Carbon tetrachloride	ND	2.0	ppb(v/v)
Benzene	ND	2.0	ppb(v/v)
1,2-Dichloroethane	ND	2.0	ppb(v/v)
Trichloroethene	ND	2.0	ppb(v/v)
1,2-Dichloropropane	ND	2.0	ppb(v/v)
cis-1,3-Dichloropropene	ND	2.0	ppb(v/v)
Toluene	**13**	**5.0**	**ppb(v/v)**
trans-1,3-Dichloropropene	ND	2.0	ppb(v/v)
1,1,2-Trichloroethane	ND	2.0	ppb(v/v)
Tetrachloroethene	ND	2.0	ppb(v/v)
1,2-Dibromoethane (EDB)	ND	2.0	ppb(v/v)
Chlorobenzene	ND	2.0	ppb(v/v)
Ethylbenzene	ND	2.0	ppb(v/v)
m-Xylene & p-Xylene	**6.4**	**2.0**	**ppb(v/v)**
o-Xylene	ND	2.0	ppb(v/v)
Styrene	ND	2.0	ppb(v/v)
1,1,2,2-Tetrachloroethane	ND	2.0	ppb(v/v)
Benzyl chloride	ND	10	ppb(v/v)
1,3,5-Trimethylbenzene	ND	2.0	ppb(v/v)
1,2,4-Trimethylbenzene	ND	2.0	ppb(v/v)
1,3-Dichlorobenzene	ND	2.0	ppb(v/v)

(Continued on next page)

TETRA TECH NUS, INC.

Client Sample ID: FT-AS0008-FB

GC/MS Volatiles

Lot-Sample #...: M0H140159-002 **Work Order #...:** DHTFT101 **Matrix.....:** AIR

PARAMETER	RESULT	REPORTING LIMIT	UNITS
1,4-Dichlorobenzene	ND	2.0	ppb(v/v)
1,2-Dichlorobenzene	ND	2.0	ppb(v/v)
1,2,4-Trichloro-benzene	ND	20	ppb(v/v)
Hexachlorobutadiene	ND	4.0	ppb(v/v)

TETRA TECH NUS, INC.

Client Sample ID: FT-AS-0010-FB

GC/MS Volatiles

Lot-Sample #...: M0J040264-001 **Work Order #...:** DLJ6E101 **Matrix.....:** AIR
Date Sampled...: 10/03/00 14:00 **Date Received..:** 10/04/00 10:30
Prep Date.....: 10/04/00 **Analysis Date..:** 10/04/00
Prep Batch #...: 0279346 **Analysis Time..:** 23:16
Dilution Factor: 1
Analyst ID.....: 064667 **Instrument ID..:** MSB
Method.....: EPA-21 TO-14A

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Dichlorodifluoromethane	ND	2.0	ppb(v/v)
Chloromethane	ND	4.0	ppb(v/v)
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	2.0	ppb(v/v)
Vinyl chloride	ND	2.0	ppb(v/v)
Bromomethane	ND	2.0	ppb(v/v)
Chloroethane	ND	4.0	ppb(v/v)
Trichlorofluoromethane	ND	2.0	ppb(v/v)
1,1-Dichloroethene	ND	2.0	ppb(v/v)
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	2.0	ppb(v/v)
Methylene chloride	ND	2.0	ppb(v/v)
1,1-Dichloroethane	ND	2.0	ppb(v/v)
cis-1,2-Dichloroethene	ND	2.0	ppb(v/v)
Chloroform	ND	2.0	ppb(v/v)
1,1,1-Trichloroethane	ND	2.0	ppb(v/v)
Carbon tetrachloride	ND	2.0	ppb(v/v)
Benzene	ND	2.0	ppb(v/v)
1,2-Dichloroethane	ND	2.0	ppb(v/v)
Trichloroethene	ND	2.0	ppb(v/v)
1,2-Dichloropropane	ND	2.0	ppb(v/v)
cis-1,3-Dichloropropene	ND	2.0	ppb(v/v)
Toluene	ND	5.0	ppb(v/v)
trans-1,3-Dichloropropene	ND	2.0	ppb(v/v)
1,1,2-Trichloroethane	ND	2.0	ppb(v/v)
Tetrachloroethene	ND	2.0	ppb(v/v)
1,2-Dibromoethane (EDB)	ND	2.0	ppb(v/v)
Chlorobenzene	ND	2.0	ppb(v/v)
Ethylbenzene	ND	2.0	ppb(v/v)
m-Xylene & p-Xylene	**2.3**	**2.0**	**ppb(v/v)**
o-Xylene	ND	2.0	ppb(v/v)
Styrene	ND	2.0	ppb(v/v)
1,1,2,2-Tetrachloroethane	ND	2.0	ppb(v/v)
Benzyl chloride	ND	10	ppb(v/v)
1,3,5-Trimethylbenzene	ND	2.0	ppb(v/v)
1,2,4-Trimethylbenzene	**2.2**	**2.0**	**ppb(v/v)**
1,3-Dichlorobenzene	ND	2.0	ppb(v/v)

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TETRA TECH NUS, INC.

Client Sample ID: FT-AS-0010-FB

GC/MS Volatiles

Lot-Sample #...: M0J040264-001 **Work Order #...:** DLJ6E101 **Matrix.....:** AIR

PARAMETER	RESULT	REPORTING LIMIT	UNITS
1,4-Dichlorobenzene	**2.2**	**2.0**	**ppb(v/v)**
1,2-Dichlorobenzene	ND	2.0	ppb(v/v)
1,2,4-Trichloro-benzene	ND	20	ppb(v/v)
Hexachlorobutadiene	ND	4.0	ppb(v/v)

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
1,2-Dichloroethane-d4	108	(70 - 130)
Toluene-d8	102	(70 - 130)
4-Bromofluorobenzene	109	(70 - 130)

TETRA TECH NUS, INC.

Client Sample ID: FT-AS-0010-OG

GC/MS Volatiles

Lot-Sample #...: M0J040264-002 **Work Order #...:** DLJ6F101 **Matrix.....:** AIR
Date Sampled...: 10/03/00 14:15 **Date Received..:** 10/04/00 10:30
Prep Date.....: 10/04/00 **Analysis Date..:** 10/04/00
Prep Batch #...: 0279346 **Analysis Time..:** 22:39
Dilution Factor: 1
Analyst ID.....: 064667 **Instrument ID..:** MSB
Method.....: EPA-21 TO-14A

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Dichlorodifluoromethane	ND	2.0	ppb(v/v)
Chloromethane	ND	4.0	ppb(v/v)
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	2.0	ppb(v/v)
Vinyl chloride	ND	2.0	ppb(v/v)
Bromomethane	ND	2.0	ppb(v/v)
Chloroethane	ND	4.0	ppb(v/v)
Trichlorofluoromethane	ND	2.0	ppb(v/v)
1,1-Dichloroethene	ND	2.0	ppb(v/v)
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	2.0	ppb(v/v)
Methylene chloride	ND	2.0	ppb(v/v)
1,1-Dichloroethane	**11**	**2.0**	**ppb(v/v)**
cis-1,2-Dichloroethene	ND	2.0	ppb(v/v)
Chloroform	ND	2.0	ppb(v/v)
1,1,1-Trichloroethane	**21**	**2.0**	**ppb(v/v)**
Carbon tetrachloride	ND	2.0	ppb(v/v)
Benzene	ND	2.0	ppb(v/v)
1,2-Dichloroethane	ND	2.0	ppb(v/v)
Trichloroethene	ND	2.0	ppb(v/v)
1,2-Dichloropropane	ND	2.0	ppb(v/v)
cis-1,3-Dichloropropene	ND	2.0	ppb(v/v)
Toluene	ND	5.0	ppb(v/v)
trans-1,3-Dichloropropene	ND	2.0	ppb(v/v)
1,1,2-Trichloroethane	ND	2.0	ppb(v/v)
Tetrachloroethene	**10**	**2.0**	**ppb(v/v)**
1,2-Dibromoethane (EDB)	ND	2.0	ppb(v/v)
Chlorobenzene	ND	2.0	ppb(v/v)
Ethylbenzene	ND	2.0	ppb(v/v)
m-Xylene & p-Xylene	**3.0**	**2.0**	**ppb(v/v)**
o-Xylene	ND	2.0	ppb(v/v)
Styrene	ND	2.0	ppb(v/v)
1,1,2,2-Tetrachloroethane	ND	2.0	ppb(v/v)
Benzyl chloride	ND	10	ppb(v/v)
1,3,5-Trimethylbenzene	ND	2.0	ppb(v/v)
1,2,4-Trimethylbenzene	**2.5**	**2.0**	**ppb(v/v)**
1,3-Dichlorobenzene	ND	2.0	ppb(v/v)

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TETRA TECH NUS, INC.

Client Sample ID: FT-AS-0010-OG

GC/MS Volatiles

Lot-Sample #...: M0J040264-002 **Work Order #...:** DLJ6F101 **Matrix.....:** AIR

PARAMETER	RESULT	REPORTING LIMIT	UNITS
1,4-Dichlorobenzene	**2.1**	**2.0**	**ppb(v/v)**
1,2-Dichlorobenzene	ND	2.0	ppb(v/v)
1,2,4-Trichloro-benzene	ND	20	ppb(v/v)
Hexachlorobutadiene	ND	4.0	ppb(v/v)

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
1,2-Dichloroethane-d4	106	(70 - 130)
Toluene-d8	108	(70 - 130)
4-Bromofluorobenzene	97	(70 - 130)

TETRA TECH NUS, INC.

Client Sample ID: FT-AS-0012-FB

GC/MS Volatiles

Lot-Sample #...: M0L060224-001 **Work Order #...:** DQXGH1AA **Matrix.....:** AIR
Date Sampled...: 12/05/00 09:30 **Date Received..:** 12/06/00
Prep Date.....: 12/06/00 **Analysis Date..:** 12/06/00
Prep Batch #...: 0348443 **Analysis Time..:** 19:49
Dilution Factor: 1
Analyst ID.....: 007319 **Instrument ID..:** MSB
Method.....: EPA-21 TO-14A

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Dichlorodifluoromethane	ND	2.0	ppb(v/v)
Chloromethane	ND	4.0	ppb(v/v)
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	2.0	ppb(v/v)
Vinyl chloride	ND	2.0	ppb(v/v)
Bromomethane	ND	2.0	ppb(v/v)
Chloroethane	ND	4.0	ppb(v/v)
Trichlorofluoromethane	ND	2.0	ppb(v/v)
1,1-Dichloroethene	ND	2.0	ppb(v/v)
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	2.0	ppb(v/v)
Methylene chloride	ND	2.0	ppb(v/v)
1,1-Dichloroethane	ND	2.0	ppb(v/v)
cis-1,2-Dichloroethene	ND	2.0	ppb(v/v)
Chloroform	ND	2.0	ppb(v/v)
1,1,1-Trichloroethane	ND	2.0	ppb(v/v)
Carbon tetrachloride	ND	2.0	ppb(v/v)
Benzene	ND	2.0	ppb(v/v)
1,2-Dichloroethane	ND	2.0	ppb(v/v)
Trichloroethene	ND	2.0	ppb(v/v)
1,2-Dichloropropane	ND	2.0	ppb(v/v)
cis-1,3-Dichloropropene	ND	2.0	ppb(v/v)
Toluene	ND	5.0	ppb(v/v)
trans-1,3-Dichloropropene	ND	2.0	ppb(v/v)
1,1,2-Trichloroethane	ND	2.0	ppb(v/v)
Tetrachloroethene	ND	2.0	ppb(v/v)
1,2-Dibromoethane (EDB)	ND	2.0	ppb(v/v)
Chlorobenzene	ND	2.0	ppb(v/v)
Ethylbenzene	ND	2.0	ppb(v/v)
m-Xylene & p-Xylene	ND	2.0	ppb(v/v)
o-Xylene	ND	2.0	ppb(v/v)
Styrene	ND	2.0	ppb(v/v)
1,1,2,2-Tetrachloroethane	ND	2.0	ppb(v/v)
Benzyl chloride	ND	10	ppb(v/v)
1,3,5-Trimethylbenzene	ND	2.0	ppb(v/v)
1,2,4-Trimethylbenzene	ND	2.0	ppb(v/v)
1,3-Dichlorobenzene	ND	2.0	ppb(v/v)

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TETRA TECH NUS, INC.

Client Sample ID: FT-AS-0012-FB

GC/MS Volatiles

Lot-Sample #...: M0L060224-001 **Work Order #...:** DQXGH1AA **Matrix.....:** AIR

PARAMETER	RESULT	REPORTING LIMIT	UNITS
1,4-Dichlorobenzene	ND	2.0	ppb(v/v)
1,2-Dichlorobenzene	ND	2.0	ppb(v/v)
1,2,4-Trichloro-benzene	ND	20	ppb(v/v)
Hexachlorobutadiene	ND	4.0	ppb(v/v)

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
1,2-Dichloroethane-d4	103	(70 - 130)
Toluene-d8	100	(70 - 130)
4-Bromofluorobenzene	115	(70 - 130)

TETRA TECH NUS, INC.

Client Sample ID: FT-AS-0012-OG

GC/MS Volatiles

Lot-Sample #...: M0L060224-002	**Work Order #...:** DQXGL1AA	**Matrix.....:** AIR	
Date Sampled...: 12/05/00 09:45	**Date Received..:** 12/06/00		
Prep Date.....: 12/06/00	**Analysis Date..:** 12/06/00		
Prep Batch #...: 0348443	**Analysis Time..:** 19:15		
Dilution Factor: 1			
Analyst ID.....: 007319	**Instrument ID..:** MSB		
	Method.....: EPA-21 TO-14A		

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Dichlorodifluoromethane	ND	2.0	ppb(v/v)
Chloromethane	ND	4.0	ppb(v/v)
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	2.0	ppb(v/v)
Vinyl chloride	ND	2.0	ppb(v/v)
Bromomethane	ND	2.0	ppb(v/v)
Chloroethane	ND	4.0	ppb(v/v)
Trichlorofluoromethane	ND	2.0	ppb(v/v)
1,1-Dichloroethene	ND	2.0	ppb(v/v)
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	2.0	ppb(v/v)
Methylene chloride	ND	2.0	ppb(v/v)
1,1-Dichloroethane	**8.3**	**2.0**	**ppb(v/v)**
cis-1,2-Dichloroethene	ND	2.0	ppb(v/v)
Chloroform	ND	2.0	ppb(v/v)
1,1,1-Trichloroethane	**22**	**2.0**	**ppb(v/v)**
Carbon tetrachloride	ND	2.0	ppb(v/v)
Benzene	ND	2.0	ppb(v/v)
1,2-Dichloroethane	ND	2.0	ppb(v/v)
Trichloroethene	ND	2.0	ppb(v/v)
1,2-Dichloropropane	ND	2.0	ppb(v/v)
cis-1,3-Dichloropropene	ND	2.0	ppb(v/v)
Toluene	ND	5.0	ppb(v/v)
trans-1,3-Dichloropropene	ND	2.0	ppb(v/v)
1,1,2-Trichloroethane	ND	2.0	ppb(v/v)
Tetrachloroethene	ND	2.0	ppb(v/v)
1,2-Dibromoethane (EDB)	ND	2.0	ppb(v/v)
Chlorobenzene	ND	2.0	ppb(v/v)
Ethylbenzene	ND	2.0	ppb(v/v)
m-Xylene & p-Xylene	ND	2.0	ppb(v/v)
o-Xylene	ND	2.0	ppb(v/v)
Styrene	ND	2.0	ppb(v/v)
1,1,2,2-Tetrachloroethane	ND	2.0	ppb(v/v)
Benzyl chloride	ND	10	ppb(v/v)
1,3,5-Trimethylbenzene	ND	2.0	ppb(v/v)
1,2,4-Trimethylbenzene	ND	2.0	ppb(v/v)
1,3-Dichlorobenzene	ND	2.0	ppb(v/v)

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TETRA TECH NUS, INC.

Client Sample ID: FT-AS-0012-OG

GC/MS Volatiles

Lot-Sample #...: M0L060224-002 **Work Order #...:** DQXGL1AA **Matrix.....:** AIR

PARAMETER	RESULT	REPORTING LIMIT	UNITS
1,4-Dichlorobenzene	ND	2.0	ppb(v/v)
1,2-Dichlorobenzene	ND	2.0	ppb(v/v)
1,2,4-Trichloro-benzene	ND	20	ppb(v/v)
Hexachlorobutadiene	ND	4.0	ppb(v/v)

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
1,2-Dichloroethane-d4	102	(70 - 130)
Toluene-d8	103	(70 - 130)
4-Bromofluorobenzene	113	(70 - 130)